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A CHARACTERISTIC OF GROWING AND DECLINING REGIONAL MANUFACTURING EMPLOYMENT TRENDS: NEW ENGLAND AND OTHER GEOGRAPHIC DIVISIONS

by

Eliahu Romanoff

Discussion Paper No. 76-4

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The purpose of this series is to encourage the earliest possible dissemination of research results. Comments and reactions are invited by the author. Appearance of a paper in this series does not preclude later formal publication in journals or elsewhere.

REGIONAL SCIENCE RESEARCH CENTER
5 Boylston Street, Cambridge, Massachusetts 02138

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Note on Census Data

In undertaking the exercise summarized in Discussion Paper Paper No. 76-4, we encountered an inconsistency in the data reported in Table 2 (p. 1-34) of the Census of Manufacturers 1972, Subject Series, General Summary MC 72(1)-1. The errors pertain to 1972 2-digit SIC employment (and payroll) of All and Operating establishments. The data given in Table 3 of our 76-4 Paper incorporate the revisions obtained from a corrected table furnished by the Industry Division of the U.S. Census, although in the absence of a written response to our inquiry, it is not known what effects these corrections have on the data organized by Geographic Divisions. According to our computations, they appear to be negligible in the aggregates employed in this paper. Hence the use of only aggregate data.

A CHARACTERISTIC OF GROWING AND DECLINING REGIONAL MANUFACTURING EMPLOYMENT TRENDS: NEW ENGLAND AND OTHER GEOGRAPHIC DIVISIONS

Introduction

The purpose of this paper is to note some observed regularities, which suggest a characteristic of growing and declining regional manufacturing employment trends. The characteristic pertains to a group of industries whose growth or decline tends to affect total manufacturing production along their production sequences. Production sequences can be described simply, first by the extraction of raw materials (natural or cultivated), then by the processing of these materials by their respective first stage manufacturing industries which produce intermediate products for further processing, and then the further processing in successive stages to produce semi-final and then final goods. The final goods are those purchased by consumers. Because of interdependence in production, a change in production of first stage industries, with the attendant change in their employment levels, has its effects on all industries in the economy.

These regularities were observed in an initial empirical tabulation of data given in the Census of Manufacturers, continuing our studies on the structure of production. Among the recent studies, additional statistical properties of the order of production as observed in U.S. Input-Output models were examined in Romanoff (1976a). The modeling of inter-industry production stages for alternative treatment of time, involving lags and leads in production was explored in Romanoff and Levine (1976).

Continuing the inquiry, census data were examined for growing and declining manufacturing employment trends, in terms of two relationships: (1) between changes in first and in successive stages employment, and (2) between changes in first stage and total employment. These relationships were examined for two cases: (a) their temporal changes in a region, New England, in three intercensus periods (1958-1963, 1963-1967, 1967-1972) associated with fluctuation in industry employment, and (b) their cross-section interregional relationships in the nine Geographic Divisions in the overall 1958-1972 period, associated with aspects of regional growth.

This initial examination of data aimed at highlighting only a particular set of relationships, and thus abstracts from other aspects of economic behavior. This, together with the highly aggregate level of exploration was intended to provide an initial description of the trends uncovered. Yet, the characteristics observed, which appear to be generally in line with the formerly cited analytical studies, justified their presentation at this time, for they imply previously overlooked insights into processes of regional growth and decline.

The paper is in four parts. First, some production characteristics of first stage industries are described and compared with those of successive stage industries of the U.S. economy. Second, the relationships between first and successive stages, and between first and total manufacturing employment trends in New England, are presented for the three intercensus periods. Third, these two relationships among Geographic Divisions are described for the overall 1958-1972 period. Finally, these findings are discussed briefly.

Some Production Characteristics of First Stage Manufacturing

It is worth while to note some of the production characteristics of these industries and compare them with industries in successive stage of production. Perhaps one of the important characteristics of first stage industries is that their analysis as a group was ignored until now. One of the main reasons for this neglect is that many industries falling into this group are generally represented by only a few establishments in each state, so that their data in many instances are withheld by the U.S. Census of Manufacturers in order to avoid disclosure. For this reason, their important contribution to the economic performance of their respective states was usually concealed by their aggregation with other industries. Only specific, large, first stage industries (e.g., steel production) were individually examined, usually nationally.

One way to gain an insight into first stage industries as a group in the national economy is obtained by the analysis of the U.S. input-output model, which provides a consistent and comprehensive set of economic accounts in order to gauge the performance of the economy. Using the 1967 input-output model, the latest available, our analysis revealed that relative production costs for first stage industries are higher than for successive industries for at least the following inputs (listed in their order of relative importance):*

*The analysis was confined to selected inputs common to all manufacturing industries. Hence the emphasis on non-manufactured inputs. Employment compensation, Property income, and Business taxes are components of value added in the national 1967 input-output model. See Romanoff (1976a) for further detail.

I-O Industry	
69	Wholesale and retail trade
--	Employee compensation
--	Property income
70	Finance and insurance
68	Electric, gas, water, and sanitary services
73	Business services
65	Transportation services
--	Business taxes
66	Communications (except radio and TV broadcasting)
71	Real estate and rentals
31	Petroleum refining and related industries
80	Imports

The array of these inputs reflects relative high production costs unique to the technology of these industries. Many of these costs, however, may be further modified by prevailing local price variations which can afford locational advantages inherent in external economies of a place. The capital intensity of first stage producers is suggested by the relative large outlays for finance and insurance, as further illustrated in Table 1, while their large relative outlays for employee compensation is discussed further below. At this time it is only sufficient to note that these latter major industry expenditures tend to vary locationally with prevailing wage rates. Similarly, the importance of inputs from transportation suggests the locational sensitivity of these industries with respect to their suppliers, including the local supply and price of their raw materials. Further, since first stage industries are engaged in the transformation of raw materials into intermediate products, a usually energy-intensive process, their relative energy costs are generally higher than for successive industries. In the 82-sector national input-output model the inputs of electricity, gas, water and sanitary services were combined. Yet these together with petroleum inputs appear to be consistent with the relative high energy demand of first stage

TABLE 1. PRODUCING INDUSTRY MEAN RELATIVE COSTS OF FINANCE AND INSURANCE, 1967

Industries	Mean Relative Inputs from Industry 70, Finance and Insurance ($ input/$ output)
Raw materials (Agric. forestry, fisheries & mining)	.0088
First Stage Mfg. (Selling more than 82.8% to intermediate use)	.0051
Successive mfg. stages	.0046

Source: Interindustry Economics Division (1974).

industries.* The relative high first stage industry expenditure for water and sanitary services hints at their role in drawing water and discharging wastewater. Past studies suggest the critical role of first stage industries in pollution abatement and control, involving water, air, and solid wastes. See for example Romanoff (1969, 1973). Indeed, many if not most of the environmental controversies involving manufacturers that engaged the public's attention in New England since the late sixties pertained to plants of first stage industries.

The relative high outlays of first stage industries for real estate and rentals suggest their role in the use of land. Here, however, the relationships between production and land use, or more specifically space use (floorspace and land), location, and other factors within a region, are quite complex. Still, our analysis of industries' use of space in metropolitan areas, Romanoff (1975), provides some support of the view that first stage industries differ from other industries in the use of space.

These relative high inputs to first stage industries suggest their locational sensitivity to cost advantages which would imply their tendency to migrate were it not for their investment at a place typical of their capital intensity. Apparently, locational changes ought then to be realized by other means than outright industrial migration generally typical of the more labor-intensive industries.

This catalog of production and related considerations of first stage industries suggests their important role in their regional

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*Petroleum inputs are used not only to generate energy, but also by chemical industries to produce their own products.

economies. Their decline has its repercussions on successive stage industries who must then import first stage industry products from other regions, thereby weakening the competitive position they used to enjoy. Conversely, their growth may improve on the locational advantage of successive stage industries and may attract some from other regions. Changes in first stage industries' employment, suggesting changes in their output levels, also affects their suppliers in terms of the latter's local markets. Many of these suppliers tend to locate in metropolitan regions, suggesting that these repercussions will be manifested mainly in these places. The result of both of these effects which represent changes in regional structure of production, will affect local interdependence, with attendant changes in output, employment and income multipliers. The repercussions on the performance of the many industries are in terms not only of their reduction in output and in labor requirements, but also as noted by Romanoff and Levine (1976), in the way inflationary pressures are transmitted throughout the economy.

Owing to the limited published data on first stage industries noted above, their identification for the purpose of this initial inquiry was confined to a few selected industries. These were industries for which the U.S. Census generally published data for 1958, 1963, 1967 and 1972, and which generally did not change their SIC definition during that period. Ten first stage industries were selected.

SIC	Title
2011	Meat packing plants
228	Yarn and thread mills
2421	Sawmills and planing mills, general
2431	Millwork
2621	Paper mills, except building paper
2631	Paperboard mills
2819	Industrial inorganic chemicals, n.e.c.
3111	Leather tanning and finishing
331	Blast furnaces and basic metal products
332	Iron and steel foundries

The relative importance of these selected first stage industries can be shown by their comparison with successive stage industries producing semi-final and final goods. To simplify the analysis the following successive stage industries were selected.*

SIC	Title
23	Apparel and other textile products
27	Printing and publishing
36	Electrical and Electronic equipment
37	Transportation equipment
38	Instruments and related products

Manufacturing employment can thus be classified into three: (1) selected first stage industries. (2) selected successive stage industries, and (3) a residual category, All Other, which includes all those first and successive stage industries not separately identified, and employment in administrative and auxiliary establishments.

Using this three-part classification, a few national labor-related production ratios of the U.S. economy, for 1972, are shown in Table 2,

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*At the aggregate level of SIC Major Groups, consisting of a list of 20 2-digit manufacturing industries, these five industries, together with SIC 39 (Miscellaneous manufacturing), exhaust the successive stage industries. Most of the other 2-digit Major groups contain both first and successive stage industries, depending on the stage classification employed.

TABLE 2. SOME PRODUCTION RATIOS OF SELECTED FIRST AND SUCCESSIVE STAGES, U. S. MANUFACTURING INDUSTRIES, 1972

	First Stage	Successive Stage	All Other	All Mfg.
Value of Shipments/Employee ($1000/person)	53.7	31.1	40.2	39.8
Value of Shipments/Manhour Production Worker ($/mh)	32.2	22.3	29.3	28.3
Payroll/Employee ($1000/person)	9.90	9.01	9.13	9.16
Wages/Production Worker ($1000/person)	9.23	7.68	7.62	7.80
Production Workers/Employee	.82	.72	.68	.71

Source: U. S. Bureau of the Census, (1975).

in order to underscore the differences between production stages. In the table, ratios of value of shipments per employee and per manhour (a crude measure of productivity) are higher for the selected first stage than for successive stage industries. The table also shows that both payroll per employee and wages per production worker were higher for first than for successive stage industries.* Further, the ratio of production workers per employee was higher for first than for successive stage industries, since the former's administrative structure is generally simpler, and they need not employ as large a salesforce as do final goods industries because their marketing channels are relatively fewer and better defined. This implies that a change in first stage industry employment when transmitted to a change in successive stage employment, will affect total manufacturing employment. As a result, all manufacturers' payroll per employee ratios will be affected, thereby also affecting the measure of personal income per capita.

Manufacturing employment trends of the U.S. economy from 1958 to 1972 classified by our three-part classification are shown in Table 3. The table shows that first stage industry's share of total manufacturing employment continuously declined during that time, whereas the share of successive stage industry employment increased from 1958 to 1967 and then declined. The growth rates shown in the table indicate a fluctuating pattern for both stages and for total employment.** They suggest that

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*Using these mean ratios, the data suggest that nationally ten first stage employees earned as much as twelve successive stage employees. These ratios, however, vary among industries in each stage, and also among regions.

**In the 1972 Census, SIC 19, Ordnance, was eliminated and its employment assigned to SIC 34,36,37 and 38, so that the data given in Table 3 for that year include ordnance industries formerly excluded, resulting in an upward bias in computed growth rates involving that year.

TABLE 3. U. S. MANUFACTURING EMPLOYMENT, 1958 TO 1972

	Employment (000)			
	1958	1963	1967	1972
Selected First Stage	1,691.2	1,631.7	1,703.8	1,601.7
Selected Successive Stage	5,035.2	5,611.2	6,491.0	6,259.7
All Other	9,298.8	9,715.5	11,128.1	11,165.4
All Mfg.	16,025.2	16,958.4	19,322.9	19,026.8
	Share (Percent)			
Selected First Stage	10.6	9.6	8.8	8.4
Selected Successive Stage	31.4	33.1	33.6	32.9
All Other	58.0	57.3	57.6	58.7
All Mfg.	100.0	100.0	100.0	100.0
	Growth (Percent)			
	58-63	63-67	67-72	58-72
Selected First Stage	- 3.5	+ 4.4	- 6.0	- 5.3
Selected Successive Stage	+11.4	+15.7	- 3.6	+24.3
All Other	+ 4.5	+14.5	+ 0.3	+20.1
All Mfg.	+ 5.8	+13.9	- 1.5	+18.7

fluctuations in first stage employment seems to be associated with fluctuations in successive stage employment and with total employment. The residual category, All Other, closely reflects the trend of the total. The fluctuating growth rates can perhaps be better observed if the three periods are rearranged by growth periods of first stage industry, i.e.:

		Average Annual Rate		
Period		First	Successive	Total
Growth	(63-67)	+1.1	+3.9	+3.5
Stability	(58-63)	-0.7	+2.3	+1.2
Decline	(67-72)	-1.2	-0.7	-0.3

In this arrangement, in a period of growth (1963-1967) in first stage employment, both successive stage and total employment increased. In a first stage stable period both successive stage and total employment still increased, though at a lower rate than in a growth period. In a period of decline, both successive stage and total employment decreased, but in contrast with the other periods, the change was at lower rates than that of the first stage.

These fluctuations are presented for subsequent comparison with those of the New England economy.

New England

The examination of New England manufacturing employment using our classification, revealed that the share of first stage to total employment continuously declined with each census year, whereas the share of successive stage employment increased from 1958 to 1967 and decreased by 1972.* This is shown in Table 4, where employment levels, their share in the region, and their growth rates are given. The trends of these shares are not unsimilar to those observed for the U.S. economy, although the percentages themselves are different. The divergence between the region and the nation can be observed in the growth rates. Generally, the signs of the growth rates are identical in both tables, the exception being the residual, All Other, reflecting different industry mixes. In New England, however, the magnitude of both positive and negative growth rates were larger than the national.

Comparing the growth rates of the two New England stages, selected first stage industry employment decreased in the first and third periods (58-63 and 67-72) and increased in the second period (63-67). In turn, successive industry employment increased in the first two periods and decreased in the third (67-72), which appears for the most part to be the response of industries in SIC 36,37, and 38 to the curtailment of government defense and space exploration expenditures since the late 60's. Thus the loss of successive stage industries in 1967-1972 more than erased the gain in 1963-1967 (i.e., -85.5 and +63.5

*For additional detail on the New England economy, and also on Massachusetts, using this approach, see Romanoff (1976b).

TABLE 4. NEW ENGLAND MANUFACTURING EMPLOYMENT, 1958 TO 1972

	Employment (000)			
	1958	1963	1967	1972
Selected First Stage	83.6	77.8	82.0	66.6
Selected Successive Stage	414.9	478.4	554.4	468.9
All Other	901.1	868.8	925.4	827.4
All Mfg.	1,399.6	1,425.0	1,561.8	1,362.9
	Shares (Percent)			
Selected First Stage	6.0	5.5	5.3	4.9
Selected Successive Stage	29.6	33.6	35.5	34.4
All Other	64.4	60.9	59.2	60.7
All Mfg.	100.0	100.0	100.0	100.0
	Growth (Percent)			
	58-63	63-67	67-72	58-72
Selected First Stage	- 6.9	+ 5.4	-18.8	-20.3
Selected Successive Stage	+15.3	+15.9	-15.4	+13.0
All Other	- 3.6	+ 6.5	-10.6	- 8.2
All Mfg.	+ 1.8	+ 9.6	-12.7	- 2.6

thousand employees). Still, successive stage industry recorded for the overall 1958-1972 period a gain of 13.0 percent. The remaining, All Other, category exhibited a moderate fluctuating pattern of growth, similar to that of total manufacturing employment in the region. These trends are illustrated in Figure 1.

An interesting pattern emerges in comparing the growth of selected first stage industries with total manufacturing. When first stage industries grew (1963-1967), total employment also grew, and at a higher rate than first stage. When first stage industries registered a slight decrease (1958-1963), total employment barely increased. When first stage industries registered a more severe decrease (1967-1972), total employment decreased. These fluctuations when rearranged by first stage growth period exhibited the following relationships:

		Average Annual Rate		
	Period	First	Successive	Total
Growth	63-67	+1.4	+4.0	+2.4
	58-63	-1.4	+3.1	+0.4
Decline	67-72	-3.8	-3.1	-2.5

Although we have only three observations, the data appear to be consistent with the remarks made earlier that because of interdependence in production, changes in first stage employment have their effects on the successive stage and on total manufacturing employment. Since, however, there are only three observations, the aggregate data were further examined in some detail.

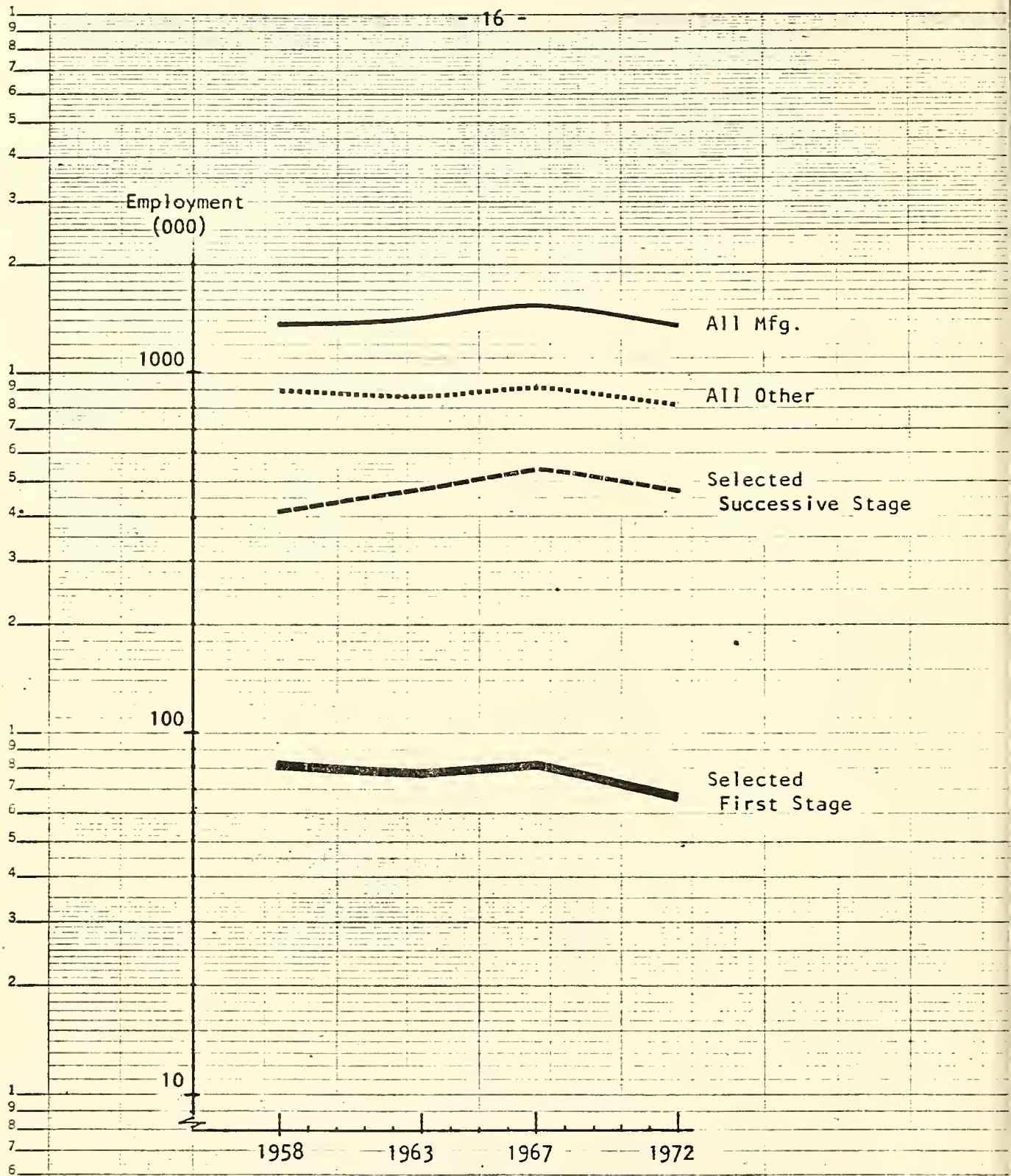

Figure 1. NEW ENGLAND MANUFACTURING EMPLOYMENT TRENDS, 1958 TO 1972

12-184
Semi-Logarithmic
4 Cycles x 10 to the inch

Production Stages and Durable and Non-Durable Industries

One commonly employed two-part classification of manufacturing employment is into durable and non-durable industries, reflecting the durability of their final products destined for investment and for consumption. By cross-classifying our classification in order also to distinguish between durable and non-durable industries, one can probe further into the relationships examined. For this purpose the cross-classification was also further refined by separating Administrative and Auxiliary employment from the All Other category.

These data revealed that in the aggregate, for the overall 1958-1972 period, New England's durable industries gained 8.0 percent, whereas non-durable industries lost 17.7 percent. Among their industry stages, Selected First Stage Durable lost 1.8 percent and Selected Successive Stage Durable gained 21.2 percent. In contrast, Selected First Stage Non-Durable lost 27.0 percent, and Selected Successive Stage Non-Durable lost only 1.3 percent. These are shown in Table 5, together with comparable data for the U.S. economy.

For the three interim periods, the data revealed divergent growth patterns between durable and non-durable industries and between stages. While selected first stage as a whole fluctuated, with growth occurring only in the 1963-1967 period, the further classification indicated that the Selected First Stage Non-Durable experienced a continuous decline, in all three periods; and Selected First Stage Durable grew between 1963 and 1967. This growth was reflected in the combined growth of Selected First Stage shown in Table 4. Among successive stage industries, both durable and non-durable grew and declined concurrently,

TABLE 5. CHANGES IN MANUFACTURING EMPLOYMENT, CROSS-CLASSIFIED BY DURABLE AND NON-DURABLE AND BY FIRST AND SUCCESSIVE PRODUCTION, NEW ENGLAND AND THE UNITED STATES, 1958-1972

(percent)

		Durable	Non-Durable	Total
Selected First Stage	N.E.	- 1.8	-27.0	-20.3
	U.S.	- 5.5	- 4.9	- 5.3
Selected Successive Stage	N.E.	+21.2[a]	- 1.3[b]	+13.0
	U.S.	+28.2[a]	+18.5[b]	+24.3
Other	N.E.	+ 0.6	-22.2	-10.4
	U.S.	+26.5	+ 6.8	+17.0
Total (operating estab.)	N.E.	+ 8.0	-17.7	- 4.0
	U.S.	+23.1	+ 9.2	+16.9
Administrative & Auxiliary	N.E.			+41.6
	U.S.			+65.1
All Mfg.	N.E.			- 2.6
	U.S.			+18.7

a SIC 36,37,38
b SIC 23,27

yet both positive and negative growth rates of successive durable far exceeded those of successive non-durable. These relationships are shown in the tabulation below.

	Average Annual Rates		
	58-63	63-67	67-72
First	-0.4	+6.2	-4.5
Successive	+4.6	+5.6	-3.9
Other	-0.3	+3.0	-1.8
Durable, total	+1.5	+4.2	-2.8
First	-2.0	-0.7	-3.3
Successive	+0.4	+0.5	-1.0
Other	-1.6	+0.3	-3.3
Non-Durable, total	-1.1	+0.2	-2.7

The data suggest that although durable and non-durable industries fluctuated at different phases, as far as these intercensus periods indicate, the relationships between first and successive stage industries were found to exhibit an association unique to each durability class. These relationships can perhaps be better observed if the data are rearranged by periods of growth, viz:

		Average Annual Rates					
		Durable		Non-Durable		Total	
Period		First	Successive	First	Successive	First	Successive
Growth	63-67	+6.2	+5.6	-0.7	+0.5	+1.4	+4.0
	58-63	-0.4	+4.6	-2.0	+0.4	-1.4	+3.1
Decline	67-72	-4.5	-3.9	-3.3	-1.0	-3.4	-3.1

Apparently, the further classification of industry stages did not greatly change the observed key relationships. The divergence in growth appears to represent the mix of industries in these still highly aggregate

classifications, and the characteristics of interindustry structure represented by these different industries.

These data suggest that the decline in employment of first stage industries stems not only from relatively short-term fluctuations in demand for their products by successive stage industries which, in turn, are affected by the demand of final users, but also by other long-term effects unique to the first stage group.

Concerning the cross-classification, it ought to be recognized that whereas the distinction between industry stages is based on interindustry linkages in production, durable and non-durable industries are not independent of each other. Some first stage durable products are used by successive stage non-durable industries in their own production. Similarly, some first stage non-durable products are used by successive stage durable industries in their own production. The examination of employment growth rates in the cross-classification suggests that at the 2-digit SIC level of aggregation, upon which the distinction between durable and non-durable industries is based, the analysis of employment trends is not analytically sufficient, and ought to be coupled at least with the distinction between industries in first and successive stages of production. This is because the aggregate 2-digit SIC classification usually conceals industry production stages. For this reason it is necessary to analyze the data in greater detail, which on the one hand recognizes the characteristics of industrial interdependence and production stages, and on the other hand takes into account the destination of end-products to their final users.

Geographic Divisions

Having described the performance of the selected first stage industries in New England at some length, the treatment of these same industries in the other geographic divisions is presented in a more concise fashion. Because of the long-term trends in the decline of first stage employment uncovered in the examination of the New England manufacturers, and of Massachusetts, in Romanoff (1976b), the analysis is confined to the overall 1958-1972 period.

Using our classification, the decline of selected first stage industry's employment in New England, 20.3 percent, was similar to the decline of these industries in the Middle Atlantic region, 20.9 percent, for a combined decline in the Northeast of 20.8 percent. These industries have also declined in two other Geographic Divisions--in the East North Central, 3.5 percent, and in the West North Central, 13.4 percent--for a combined effect for the North Central region of a decline of 5.5 percent. These are shown in Table 6. In contrast, the other five geographic divisions of the South and the West exhibited varying growth rates. Only the East South Central barely exhibited any growth, 0.2 percent. This division is part of the Appelachian Region. Perhaps the retardation in growth of these industries was associated with prevailing economic conditions in Appalachia. Selected first stage industry employment grew most in the Mountain, 24.4 percent, and South Atlantic, 6.2 percent. This suggests the diffusion of these industries from their previous concentration in the industrial belt (i.e., in the Northeast and East North Central).* An insight into the magnitude of the inter-regional

*In 1958 the Industrial Belt accounted for 53.7 percent of U.S. selected first stage employment. By 1972 the share dropped to 50 percent.

TABLE 6. CHANGES IN MANUFACTURING EMPLOYMENT OF TOTAL, SELECTED FIRST AND SUCCESSIVE STAGE INDUSTRIES, BY CENSUS REGION AND GEOGRAPHIC DIVISION, 1958-1972

(Percent)

Census Region & Geographic Division	All Mfg.	First Stage	Successive Stage	All Other
Northeast	- 3.9	-20.8	- 2.1	- 2.7
New England	- 2.6	-20.3	+13.0	- 8.2
Middle Atlantic	- 4.4	-20.9	- 6.2	- 0.5
North Central	+17.4	- 5.5	+19.8	+20.6
East No. Central	+15.8	- 3.5	+15.8	+19.5
West No. Central	+24.6	-13.4	+40.5	+24.8
South	+51.1	+ 3.8	+92.2	+46.8
So. Atlantic	+45.3	+ 6.2	+90.2	+39.4
East So. Central	+60.2	+ 0.2	+97.4	+61.5
West So. Central	+55.9	+ 2.8	+90.8	+52.0
West	+30.0	+ 7.8	+31.7	+33.1
Mountain	+67.7	+24.4	+210.3	+44.5
Pacific	+24.3	+ 2.8	+43.2	+16.4
U.S.	+18.7	- 5.3	-24.3	+20.1

redistribution of selected first stage industry employment may be obtained from noting some actual gains and losses. For example, for the overall 1958-1972 period, the Northeast lost 89.9 thousand employees, which is almost equal to the total net loss of the U.S. economy of 89.5 thousand employees. The combined loss of the Northeast and the North Central accounted for 121.5 thousand employees. This loss compares with the combined gain of the South and the West of 32.0 thousand employees (i.e., -121.5 + 32.0 = -89.5,U.S. net loss).

The relationship between changes in first and in successive stage industry employment in the nine Geographic Divisions again suggested a reasonable association. Generally, the higher the rate of first stage industry employment growth, the higher the rate of growth of successive stage industry; the more severe the decline in first stage industry, the smaller the growth of successive stage industry employment.

The other relationship, between changes in first stage industry employment and changes in total manufacturing employment, appears even clearer in this cross-sectional analysis. Regions which experienced a marked increase in first stage industry employment have also experienced a marked increase in total employment. On the other hand, regions which experienced a marked decrease in first stage industry employment have experienced a modest decrease in total manufacturing employment. There remains the inbetween case of regions which experienced only a moderate decrease in first stage industry employment. In these regions total manufacturing employment only moderately increased during the 1958-1972 period. See Figure 2.

These relationships appear to portray the characteristics of growing and declining regional manufacturing employment trends.

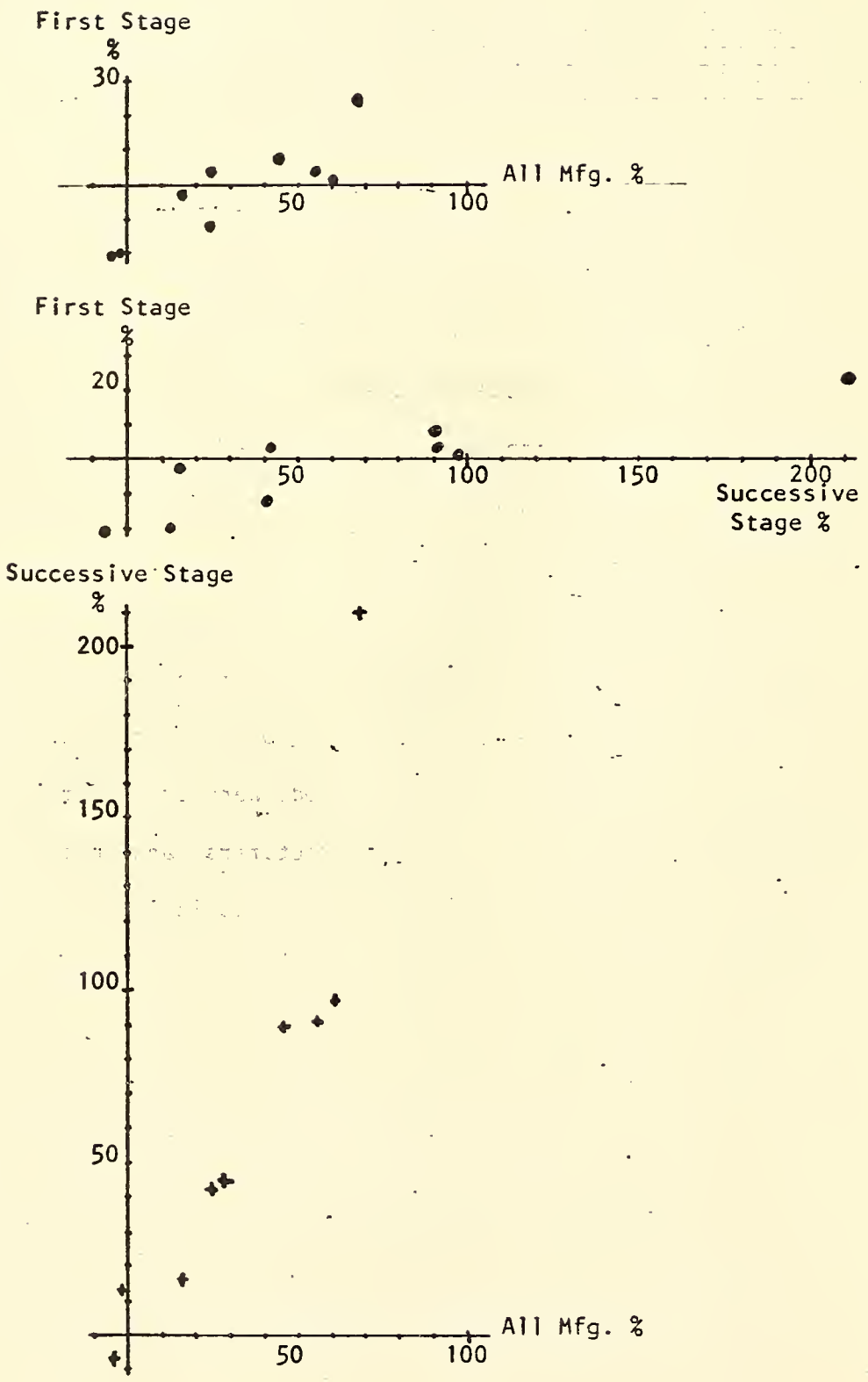

Figure 2. PERCENT CHANGE IN SELECTED FIRST AND SUCCESSIVE STAGE AND TOTAL MANUFACTURING EMPLOYMENT, GEOGRAPHIC DIVISIONS, 1958-1972.

Concluding Remarks

In this paper an insight into a few key relationships in regional manufacturing employment trends were presented, based on an initial empirical investigation undertaken in support of our previous studies into the structure of regional economies. Of particular interest at this time was the role of industries in first stages of production in their respective regional economies, as may be simply observed in growing and declining regional manufacturing employment trends. The initial inquiry thus focused on two relationships, between changes in selected first stage and in selected successive stage manufacturing employment, and between changes in selected first stage and changes in total manufacturing employment. These two relationships were briefly examined in terms of their temporal changes within a region (New England, and to some extent the U.S. economy), where the periods were of intermediate duration as obtained from the Census of Manufacturers, and in terms of their cross-sectional changes among the nine Geographic Divisions, for a longer period, 1958-1972.

Concerning temporal changes in employment, the data for both the New England and the U.S. economies revealed a reasonable association between each pair of employment categories, as obtained for sets of three observations each. These relationships, when rearranged by their growth periods revealed, for example, the following:

		Average Annual Rate					
		New England			U.S.		
Period		First	Successive	Total	First	Successive	Total
Growth	(63-67)	+1.4	+4.0	+2.4	+1.1	+3.9	+3.5
Stability	(58-63)	-1.4	+3.1	-0.4	-0.7	+2.3	+1.2
Decline	(67-72)	-3.8	-3.1	-2.5	-1.2	-0.7	-0.3

These data, together with the more detailed information on industry stages cross-classified by New England's durable and non-durable industries, also imply that the effects of first stage on the other industry categories tend to be different in periods of growth than in periods of decline. This suggests that processes of decline are not the reverse of growth processes, but rather that each represents a unique mechanism. In terms of their dynamic framework, these fluctuations imply that successive stage industries tend to oscillate out of phase with first stage industries, representing perhaps an interstage lag. These fluctuations appear to be not inconsistent with the approach to sequential interindustry modeling given by Romanoff and Levine (1976), which stressed the structural point of view involving the transmission of economic impulses among industries along their production sequences. According to this view the differences in the data for New England and the U.S. in the above tabulation stem from their different interindustry structure, interregional linkages, and industry production characteristics.

The decline in New England's first stage industry employment in the overall 1958-1972 period seems to stem not only from relatively short-term fluctuations in demand for their products by successive stage industries, but also from other, long-term effects. These effects, however, must still be investigated, for other regions experienced growth.

Involved are changes in industry productivity, production costs and related factors, some of which were noted in the eariy part of this paper. The relative importance of these and other effects must still be determined.

Concerning interregional changes, the data for the nine Geographic Divisions revealed a reasonable association between changes in selected first stage industry employment and changes in both selected successive stage and total manufacturing employment, as shown in Figure 2. Although one could easily fit curves to these quite "well behaved" plots and formulate a simple mechanistic model, we purposely refrained from doing so, since the purpose of this exploration was only descriptive--to note the general characteristics of the relationships observed.* They appear to be symptomatic of complex causes only some of which were noted in this paper. It is only once a fuller list of first and successive stage industries are analyzed in the context of a much more disaggregated framework that the analysis can further support modeling efforts. By separately identifying this analytically neglected group, their reasons for change and their effects on other industry groups can be examined. Here, however, a caveat is in order. The role of industry stages given in this paper should not be confused with the classification of basic and non-basic industries of the naive economic base model.** In fact, the data imply that the multipliers

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*In this preliminary examination, only about 40 percent (see Table 3) of the 1972 U.S. manufacturing employment was identified by production stages.

**See Romanoff (1974) for a critical evaluation of the economic base approach.

involved are not as simple as ordinary regional multipliers, and if fluctuations are to be considered their formulation may, perhaps, require the use of second order linear systems. If any, the analytical use of first stage industries, in the context of regional development, bears a certain affinity to Perroux's (1955) concept of growth poles, although with different emphasis, and within a dynamic framework. The fuller discussion of this approach must, however, be deferred to another time. In the meantime, the relationships uncovered by this simple exercise are important in themselves, for they suggest a distinguishing characteristic of growing and declining regional manufacturing employment trends.

Still, the relationships presented are based on the forward and backward linkages first stage industries have with all other industries. The analysis of these linkages is important to the formulation of economic development strategies as originally set forth by Hirschman (1958). Since that time the analysis of these structural linkages was further developed, leading to recommended policies to be applied to a variety of situations. It appears, however, that in the context of the highly industrialized and highly urbanized Geographic Divisions that lost in first stage industry employment, the causes of decline may be coupled with metropolitan growth and expansion problems. These problems focus on the megalopolis of the Northeast originally noted by Gottmann (1964), which now possibly stretches from southern Maine to central Virginia, and on its expanding counterparts in the North Central region. Involved are not only locational choices stemming from production costs internal to plant operations, but also external costs associated with agglomoration economies and diseconomies, as outlined by Isard (1958). These must

be coupled with investment considerations for economic growth, given, for example, in Burmeister and Dobell (1970), and with the supply of resources, including energy, land, and human, including also those suggested by Chinitz (1961), and last but not least, environmental considerations. Under these conditions, the organization of data for regional analysis outlined, for example, by Leven et al. (1970), becomes even more important, including the provision for more complete information on first stage industries. The ensuing analysis can thus provide more comprehensive and updated insights into processes of regional growth and decline, and suggest new possibilities for their development.

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